AEDG Implementation Recommendations: Ventilation

The Advanced Energy Design Guide (AEDG) seeks to achieve 30 percent savings over Standard 90.1-1999. This guide focuses on improvements to small office buildings, less than 20,000 square feet. The recommendations below are adapted from the implementation section of the guide, and should be used in cooperation with the whole document.* The full design guide is available from the ASHRAE website, Advanced Energy Design Guide for Small Office Buildings .

Ventilation Air

The amount of outdoor air should be based on ANSI/ASHRAE Standard 62-2001 but in no case be less than the values required by local code. The number of people used in computing the ventilation quantity required should be based on either the known occupancy, local code, or Standard 62.

Each air-conditioning or heat pump system should have an outdoor air connection through which ventilation air is introduced and mixes with the return air. The outdoor air can be mixed with the return air either in the ductwork prior to the air-conditioning or heat pump unit or at the unit''s mixing plenum. In either case, the damper and duct/plenum should be arranged to promote mixing and minimize stratification.

An air economizer mode can save energy by using outdoor air for cooling in lieu of mechanical cooling when the temperature of the outdoor air is low enough to meet the cooling needs. The system should be capable of modulating the outdoor air, return air, and relief air dampers to provide up to 100 percent of the design supply air quantity as outdoor air for cooling.

Systems should use a motorized outdoor air damper instead of a gravity damper to prevent outdoor air from entering during the unoccupied periods when the unit may recirculate air to maintain setback or setup temperatures. The motorized outdoor air damper for all climate zones should be closed during the full unoccupied period except where it may open in conjunction with an economizer cycle.

Demand control ventilation should be used in areas that have varying and high occupancy loads during the occupied periods to vary the amount of outdoor air in response to the need in a zone. The amount of outdoor air could be controlled by carbon dioxide sensors that measure the change in carbon dioxide levels in a zone relative to the levels in the outdoor air. A controller will operate the outdoor air, return air, and relief air dampers to maintain proper ventilation.

Exhaust Air

Central exhaust systems for toilet rooms, janitor closets, etc., should be interlocked to operate with the air-conditioning or heat pump unit except during unoccupied periods. These exhaust systems should have a motorized damper that opens and closes with the operation of the fan. The damper should be located as close as possible to the duct penetration of the building envelope to minimize conductive heat transfer through the duct wall and avoid having to insulate the duct. During unoccupied periods, the damper should remain closed, even while the air conditioning or heat pump unit is operating, to maintain setback or setup temperatures.

Control Strategies

The use of control strategies can help to reduce energy. Time-of-day scheduling is useful when it is known which portions of the building will have reduced occupancy. Control of the ventilation air system can be tied into this control strategy.

Carbon Dioxide Sensors

The number and location of carbon dioxide sensors for demand-control ventilation can affect the ability to accurately reflect the building or zone occupancy. A minimum of one CO2 sensor per zone is recommended for systems with greater than 500 cfm of outdoor air. Multiple sensors may be necessary if the ventilation system serves spaces with significantly different occupancy expectations. Where multiple sensors are used, the ventilation should be based on the sensor recording the highest concentration of CO2.

Sensors used in individual spaces with high outdoor air requirements (e.g., conferences rooms) should be installed on a wall within the space; for multiple spaces of similar occupancy (i.e., private offices), a return air duct-mounted sensor may be more cost-effective and provide an average CO2 measure for the zone. For sensors mounted in return air duct, adequate access for sensor calibration and field test must be provided. The number and location of sensors should take into account the sensor manufacturer''s recommendations for their particular products.

The demand ventilation controls should maintain CO2 concentrations less than or equal to 600 ppm plus the outdoor air CO2 concentration in all spaces with CO2 sensors. However, the outdoor air ventilation rate should not exceed the maximum design outdoor air ventilation rate required by code regardless of CO2 concentration. The outdoor air CO2 concentration can be assumed to be 400 ppm without any direct measurement, or the CO2 concentration can be monitored using a CO2 sensor located near the position of the outdoor air intake.

CO2 sensors should be certified by the manufacturer to have an accuracy of no less than 75 ppm, factory calibrated and calibrated periodically as recommended by the manufacturer.

Economizers

Economizers should be employed on air conditioners to help save energy by providing free cooling when ambient conditions are suitable to meet all or part of the space cooling load. Consider using enthalpy controls (vs. dry-bulb temperature controls) to help ensure that unwanted moisture is not introduced into the space in hot, humid climates.
